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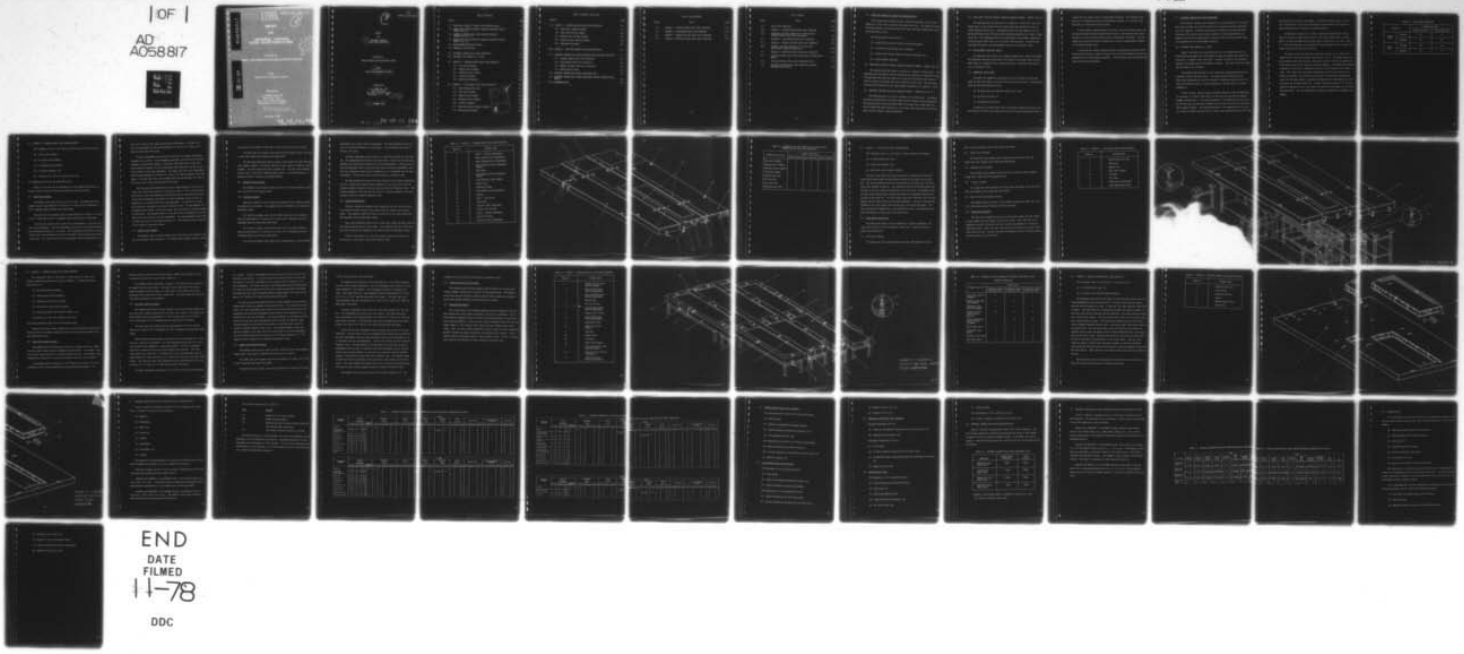

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REPORT NO. 1737-10-2

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REPORT

ON

UNIVERSAL PONTOON HATCH COVER SUBSYSTEMS

Prepared For

NAVAL SHIP RESEARCH AND DEVELOPMENT CENTER

Under

Contract No. N00600-75-D0814

Prepared By

J. J. HENRY CO., INC
West Park Drive
Mt. Laurel Industrial Park
Moorestown, N.J. 08057

November 1976

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(12) 57p.

(11) November 1976

ABSTRACT

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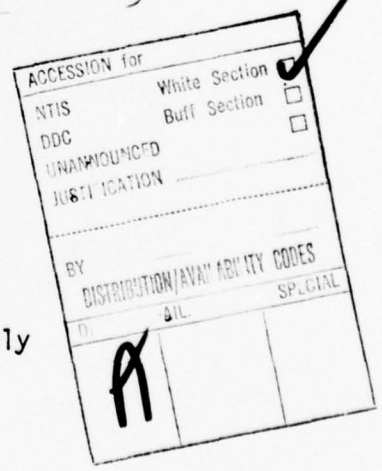

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ABSTRACT

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1-1. BREAK BULK CAPABILITY CONCEPT FOR CONTAINER SHIPS

This concept would provide non-self sustaining container ships with the capability of being self sustaining palletized load ships. The capability would allow the removing of palletized loads from cargo containers stowed above or below pontoon hatch covers.

The system concept would consist of:

(a) an Above Hatch Vertical Material Handling Subsystem,

(b) a Universal Pontoon Hatch Cover Subsystem,

(c) a Below Hatch Vertical Material Handling Subsystem, and

(d) a Replenishment Subsystem.

1-2. ABOVE HATCH VERTICAL MATERIAL HANDLING SUBSYSTEM CONCEPT - REPORT 1737-11-1

The subsystem would be stowed in containers, located on a hatch cover. The subsystem would be removed from the containers and erected by an industrial truck. The subsystem would have the capability of removing palletized loads from containers located on the hatch cover and stacked up to four high. The palletized load would be transferred to the replenishment subsystem by an industrial truck.

1-3. UNIVERSAL PONTOON HATCH COVER SUBSYSTEM CONCEPT - REPORTS 1737-10-1 & 2

The subsystem would fit any 20' container hold configuration. The subsystem would be penetrated by the below hatch vertical material handling subsystem. The subsystem would allow palletized loads to be moved from a below hatch container through the hatch cover and on to the hatch cover top plate by the below hatch vertical material handling subsystem.

1-4. BELOW HATCH VERTICAL MATERIAL HANDLING SUBSYSTEM CONCEPT - REPORT 1737-11-2

The subsystem would be contained in a volume of 8' wide by 20' long and a height equal to the distance from the lowest below deck container to one container above the hatch cover. The subsystem would have the capability of removing palletized loads from below hatch containers stacked up to 2 deep, 8 wide, and 6 high. The subsystem would lift the palletized load through a penetration in the universal hatch cover up to the hatch cover top plate. The palletized load would be moved to the replenishment system by an industrial truck.

1-5. REPLENISHMENT SUBSYSTEM CONCEPT

The subsystem would consist of a sending assembly and a receiving assembly. The subsystem would permit horizontal off-loading of palletized loads from the hatch cover of a sending ship to a receiving ship or a receiving land facility up to a distance of 150'.

1-6. COMMERCIAL APPLICATIONS

The break bulk capability system would allow off-loading of palletized cargo in those areas where a full facilities port exist and also, in those places where the following conditions exist;

(a) No hatch cover and container removal facilities,

(b) No dock facilities, or

(c) No anchoring facilities.

In those ports without hatch cover and container handling facilities, but with docking facilities, the sending ship would off-load the palletized cargo to

a receiving land station using a replenishment subsystem. The subsystem would consist of a sending and receiving replenishment assembly, or a railway receiving crane, or a motorized receiving crane.

In those harbors without docking facilities, but with anchoring areas, the sending ship would off-load the palletized cargo to a smaller break bulk receiving boat or a land receiving station using a replenishment subsystem. The subsystem would consist of either a sending and a receiving replenishment assembly or a floating receiver crane.

In the open sea, without anchoring areas, the sending ship would off-load the palletized cargo to a smaller break bulk ship using the sending and receiving assemblies of the replenishment subsystem. The off-loading would be accomplished, while both ships were underway.

2-1. UNIVERSAL PONTOON HATCH COVER SUBSYSTEMS

Four different concepts were developed for covering hatches of a container hold, when the above and the below hatch vertical material handling subsystems are to be installed. The hatch cover would be installed after the below hatch containers (flat racks) and the vertical material handling subsystem was emplaced, but prior to the emplacement of the above hatch vertical material handling subsystem and the replenishment subsystem.

2-2. RATIONALE FOR CONCEPTS A, B, AND C

Ideally, the hatch cover subsystem would be a 3-D (dimensional) device which would be expandable and contractable, between the minimum and maximum configuration, in length, width, and height. In order to simplify the conceptual approach, the height would be considered a constant. This would leave the length and the width as the variables.

The optimum width (derived from all hatch cover configurations) would be treated as sections and gap fillers. The optimum length (derived from all hatch cover configurations) would be treated as telescoping sections (port, inboard, and starboard cover or sealing assemblies), and gap fillers (T-section assemblies).

Either the port, inboard, and/or starboard assemblies would be penetrated by an access of at least X feet wide by Y feet long (derived from the adapter assembly configuration). The width measurement of the penetration would be set by the fact that the applicable assembly would be moved directly over the below hatch adapter assembly. The length measurement of the penetration would be set as an optimum distance (derived from all hatch cover configurations) and set from

the beginning to the end of the assembly. An adapter assembly access of less than X feet wide by Y feet long would require a modification of the adapter assembly penetration area because of interface problems.

As described in Report No. 1737-10-1, Container Ship Hatch Cover Sizes, there are two basic types of hatch covers. One type of hatch cover is longer than it is wide; the other type of hatch cover is wider than it is long. Table 2-1 lists the minimum and maximum length and width dimensions of both types; the longer than wide and the wider than long.

The width of the 3-D hatch cover would vary from 26' to 77'; while, the length of the 3-D hatch cover would vary from 21' to 44'. The width presents no great problem, other than possibly limiting the width of the area of penetration by the below hatch vertical material handling subsystem. The length does present a problem, in that two 21' telescoping sections will not extend to 44' without a gap. Also, that a 44' two section telescoping cover will not retract to 21' without an overhang. One alternative solution is a three section telescoping cover, but the heavy weight, the method of penetration and the complexity of design makes the solution impractical. Another alternative solution is a two configuration approach; one for the longer than wide cover and another for the wider than long cover. This two configuration approach is described in subsequent paragraphs.

TABLE 2-1. HATCH COVER DIMENSIONS

Dimension		Hatch Cover Type	
		Longer Than Wide	Wider Than Long
Length (Ft)	Minimum	42	21
	Maximum	44	35
Width (Ft)	Minimum	26	35
	Maximum	28	77

3-1. CONCEPT A - STANDARD WEIGHT HATCH COVER SUBSYSTEM

This subsystem, Table 3-1 and Figure 3-1 would consist of the following;

(a) a port cover assembly,

(b) an inboard cover assembly,

(c) a starboard cover assembly,

(d) a T-section assembly, and

(e) a forward, aft, port and starboard cover seal.

All assemblies would be of the telescoping type.

Table 3-2 lists the various combinations of the assemblies and seals required to make up three, four and eight container wide hatch covers.

3-2. Port Cover Assembly

The assembly would close the port side of a hold. The longer than wide assembly would be approximately 8'0" wide by 2'0" high by 42'0" (retracted) or 44'0" (extended) deep and weigh about 9568 pounds.

The wider than long assembly would be approximately 8'0" wide by 2'0" high by 21'0" (retracted) and 35'0" (extended) deep and weigh about 11840 pounds.

The port cover assembly would comprise two subassemblies; a long port and a short port subassembly. The long subassembly would consist of two parallel channels and webbing attached to a top plate. This subassembly would have a port and forward skirt plate attached to the parallel channels. Each skirt plate would have a cover seal. The longer than wide, long subassembly would be approximately 8'0"

wide by 2'0" high by 40'0" deep and weigh about 8320 pounds. The wider than long, long subassembly would be approximately 8'0" wide by 2'0" high by 21'0" deep and weigh about 6720 pounds.

The short subassembly would consist of two parallel channels and webbing attached to a top plate. This subassembly would have a port and aft skirt plate attached to the parallel channels. Each skirt plate would have a cover seal. The two parallel channels of short subassembly would telescope into the two parallel channels of the long subassembly. The longer than wide, short subassembly would be approximately 8'0" wide by 2'0" high by 6'0" deep and weight about 1248 pounds. The wider than long, short assembly would be approximately 8'0" wide by 2'0" high by 16'0" deep and weigh about 5120 pounds.

The long and short subassemblies would be locked together by quick acting clamps after setting the assembly to the desired length. The top plate and the skirt plate of the long subassembly would overlap the top plate and skirt plate of the short subassembly, when either the short subassembly would be fully extended out of or retracted into the long subassembly. The overlap of the top plate and skirt plate would be closed by industrial tape. The gaps between the overlapping skirt plates, at the cover seals, would be closed by standard lengths of cover seals. The standard length of cover seal would be attached to the inner face of the skirt plate of the long subassembly. The long subassembly would have at least four cover lift fittings attached to it. The assembly would be secured to the coaming by adjustable clamps.

3-3. Inboard Cover Assembly

The assembly would close the inboard areas of the hold, not covered by the port and starboard cover assemblies. The inboard cover assembly would be similar

to the port cover assembly, except that it would not have port skirt plates.

The wider than long assembly would weigh about 8372 pounds; while the longer than wide assembly would weigh about 10360 pounds.

The long subassembly would have an access, large enough to accept the hatch cover adapter assembly. The access, when not in use, would be closed by a plate assembly. The cover plate would have a weather seal. The cover plate assembly would be held in position by webbing spanner plates. The plates would be removable and held in position by standard hardware.

3-4. Starboard Cover Assembly

The starboard cover assembly would be similar to the port assembly, except that it would be of the opposite hand.

3-5. T-Section Assembly

Open areas between the port, inboard and starboard cover assemblies would be enclosed by T-assemblies. The assembly would be attached to the coaming by adjustable clamps.

The T-section assembly used with the longer than wide cover assemblies would be approximately 2'0" wide by 2'0" high by 42'0" (retracted) and 44'0" (extended) deep and weigh about 2496 pounds.

The T-section assembly used with the wider than long cover assemblies would be approximately 2'0" wide by 2'0" high by 21'0" (retracted) and 35'0" (extended) deep and weigh about 3120 pounds.

The T-section assembly would comprise two subassemblies; a long T-section

subassembly and a short T-section subassembly. The long subassembly would consist of a top plate attached to a box channel. This subassembly would have a forward skirt plate.

The short subassembly would consist of a top plate attached to a box channel. This subassembly would have an aft skirt plate. The box of the short subassembly would telescope into the box of the long subassembly. The top plate of the long subassembly would overlap the top plate of the short subassembly, when the short subassembly would be fully extended out of or retracted into the long subassembly. The top plate overlap would be sealed by industrial tape.

The gaps between the fore and aft skirt plates of the T-section assemblies and port, inboard and starboard cover assemblies, at the cover seal, would be closed by standard lengths of fore and aft cover seals and industrial tape. The overlaps between the fore and aft skirt plate of T-section assemblies and cover assemblies would be closed by industrial tape.

3-6. Subsystem Emplacement

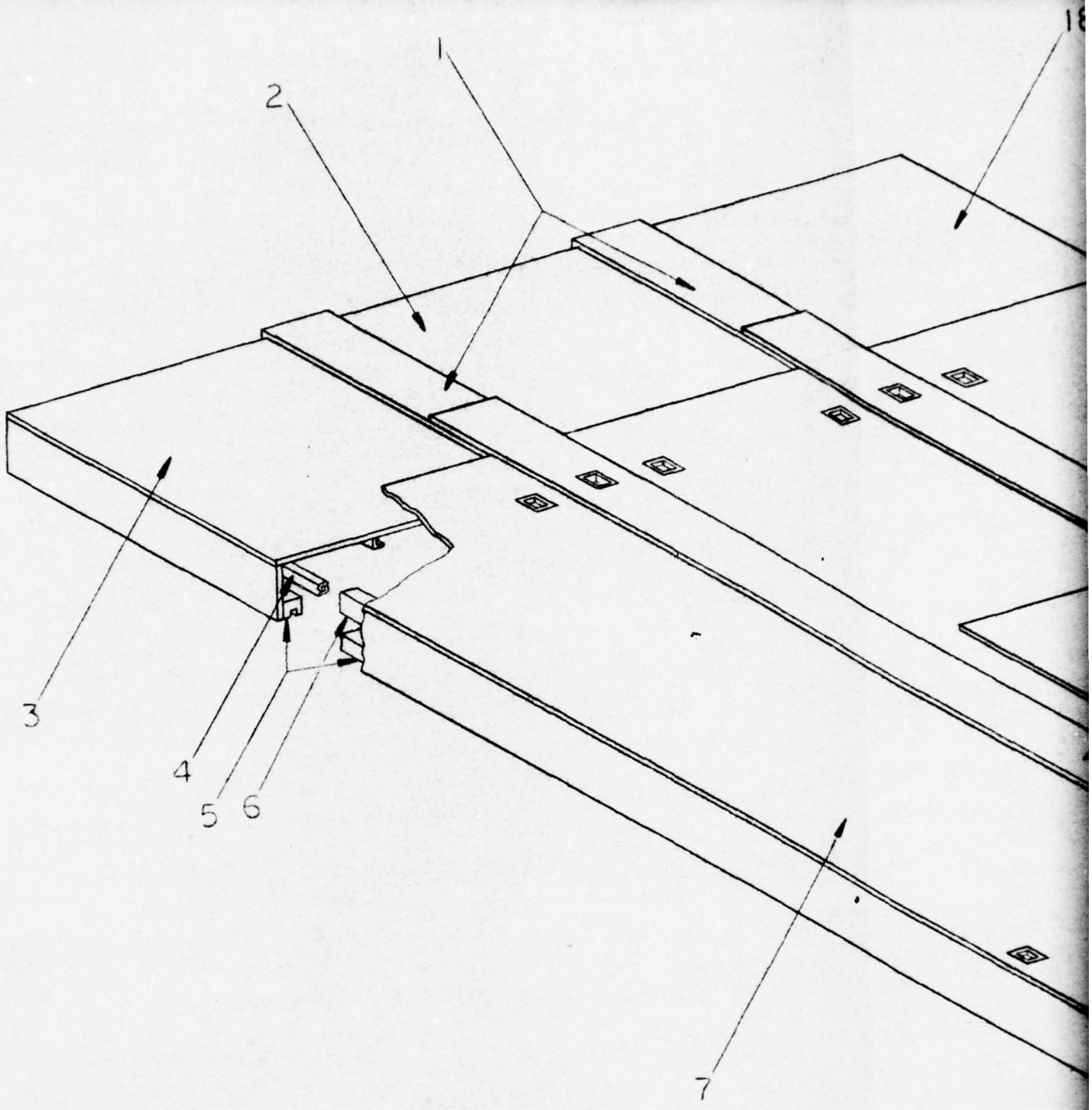
The port, inboard and starboard cover assemblies would be set to the desired length and then locked at that length using the integral quick acting clamps. The assemblies would be lifted into position on the hatch coaming and then fastened using the adjustable clamps.

Next, the T-assemblies would be set to the proper length and then locked to that length using the quick acting clamps. The assemblies would be lifted onto the cover assemblies and attached to the coaming using the adjustable clamps.

Finally, the forward, aft, port and starboard cover seals would be installed and all other gaps closed with industrial tape.

TABLE 3-1. CONCEPT A - STANDARD WEIGHT HATCH COVER SUBSYSTEM

Index No.	Assembly Name
1	Short T - Section Subassembly
2	Short Inboard Cover Subassembly
3	Short Starboard Cover Subassembly
4	Short Starboard Cover Subassembly Channel
5	Cover Seals
6	Long Starboard Cover Subassembly Channel
7	Long Starboard Cover Assembly
8	Access Plate
9	Adjustable Clamps
10	Long Inboard Cover Subassembly
11	Webbing
12	Long T - Box Section
13	Cover Seals
14	Long Port Cover Subassembly
15	Forward Lift Fittings
16	Long T - Section Subassembly
17	Aft Lift Fittings
18	Short Port Cover Subassembly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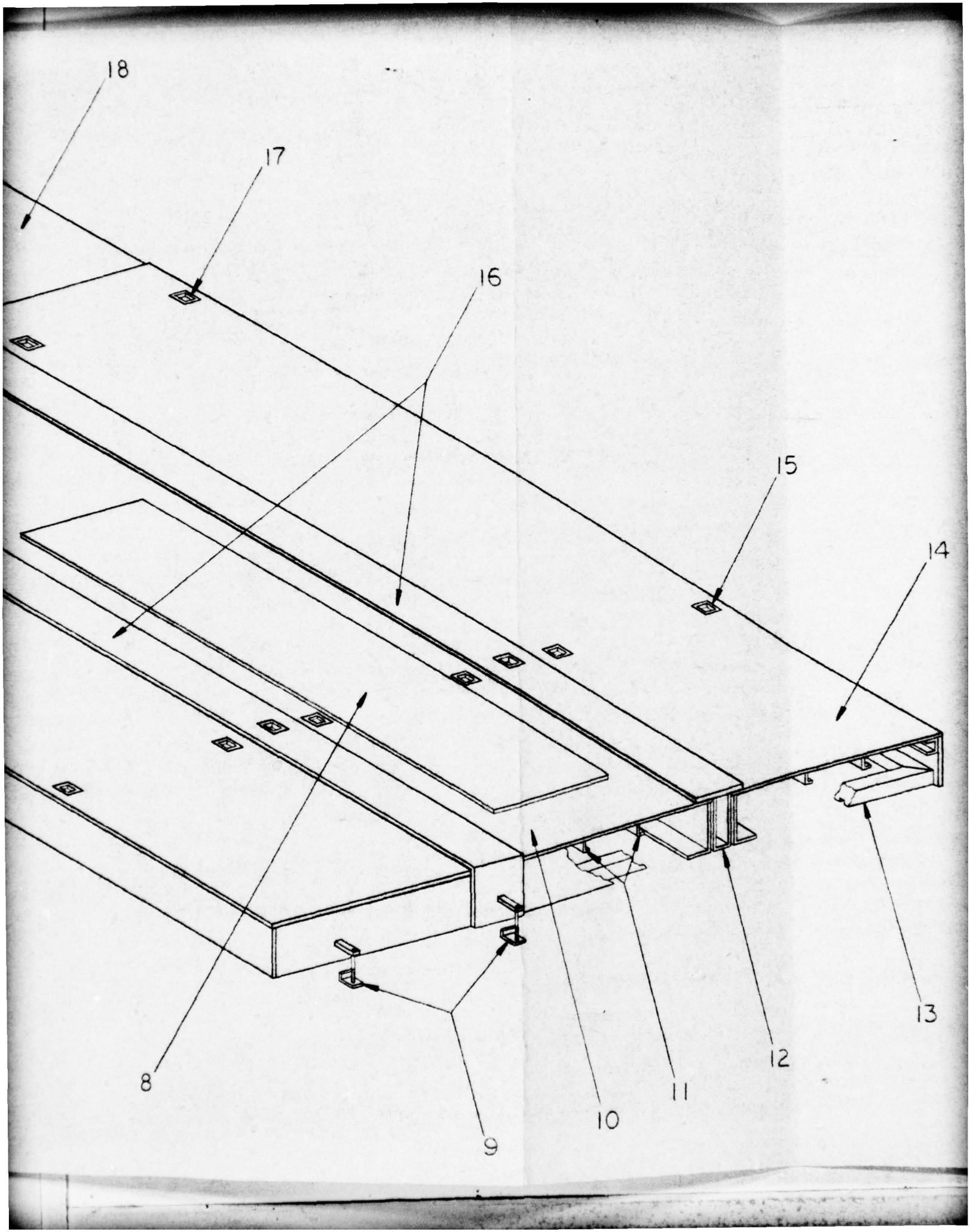
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TABLE 3-2. ASSEMBLIES AND SEALS REQUIRED FOR VARIOUS WIDTH STANDARD WEIGHT HATCH COVER SUBSYSTEMS

Assemblies and Seals	Hatch Cover Width		
	Three Container	Four Container	Eight Container
Port Cover Assembly	1	1	1
Inboard Cover Assembly	1	2	6
Starboard Cover Assembly	1	1	1
T-Section Assembly	2	3	7
Forward Cover Seal	2	3	7
Aft Cover Seal	2	3	7
Port Cover Seal	1	1	1
Starboard Cover Seal	1	1	1

4-1. CONCEPT B - LIGHT WEIGHT HATCH COVER SUBSYSTEM

This subsystem, Table 4-1 and Figure 4-1 would feature the following;

(a) a light weight hatch cover,

(b) hatch cover adapters, and

(c) hatch cover house adapter assembly.

The load of the hatch cover would be partially transferred to the hatch cover coaming and through the below hatch containers (flat racks) to the tank top. This load transference would be accomplished by the hatch cover and hatch cover house adapters assemblies. The assemblies would be positioned between the top most row of flat racks and the bottom of the hatch cover. Each adapter assembly would weigh approximately 30 pounds and consist of adjustable support posts and jack screw assemblies. The inner support post would telescope into the outer support post and thus provide coarse height adjustment. The jack screw would be attached to the inner support post and provide a fine height adjustment. The jack screw would be topped with a load distribution plate. The plate would contact the bottom of the top plate of the hatch cover.

4-2. Light Weight Hatch Cover

The cover would consist of cover assemblies, T-section assemblies, and cover seals similar in size to Concept A, except that it would be lighter in weight and construction.

4-3. Port Cover Assembly

The longer than wide assembly would weigh about 5600 pounds; while the

wider than long assembly would weight about 7840 pounds.

4-4. Inboard Cover Assembly

The wider than long assembly would weigh about 4720 pounds; while the longer than wide assembly would weigh about 6608 pounds.

4-5. Starboard Cover Assembly

The starboard cover assembly would be similar to the port cover assembly, except that it would be of the opposite hand.

4-6. T-Section Assembly

The longer than wide assembly would weigh about 880 pounds; while the wider than long assembly would weigh about 1232 pounds.

4-7. Hatch Cover House Adapter Assembly

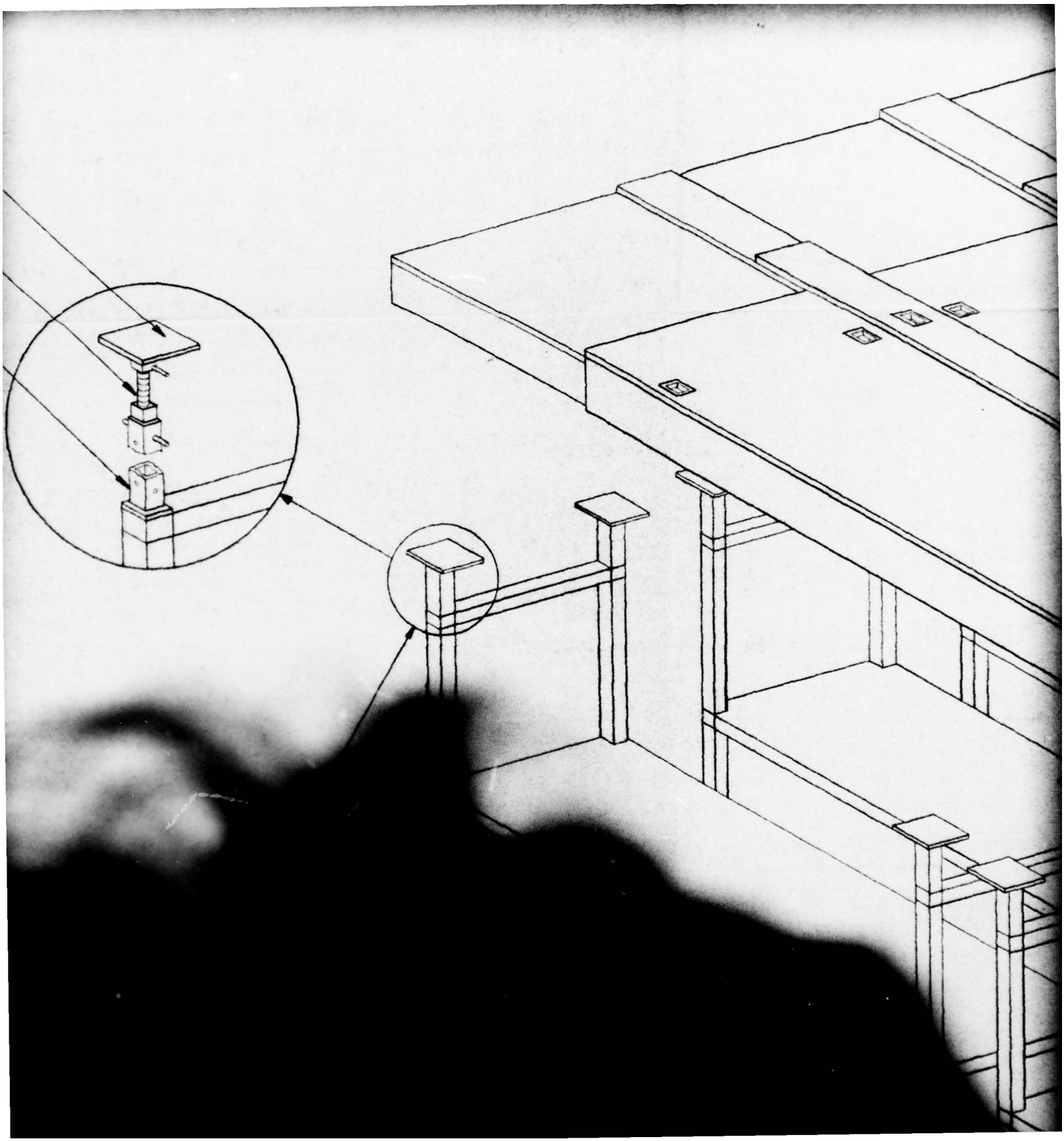
The assembly would be similar to the assembly described in Report No. 1737-11-2, Below Hatch Vertical Material Handling Subsystem.

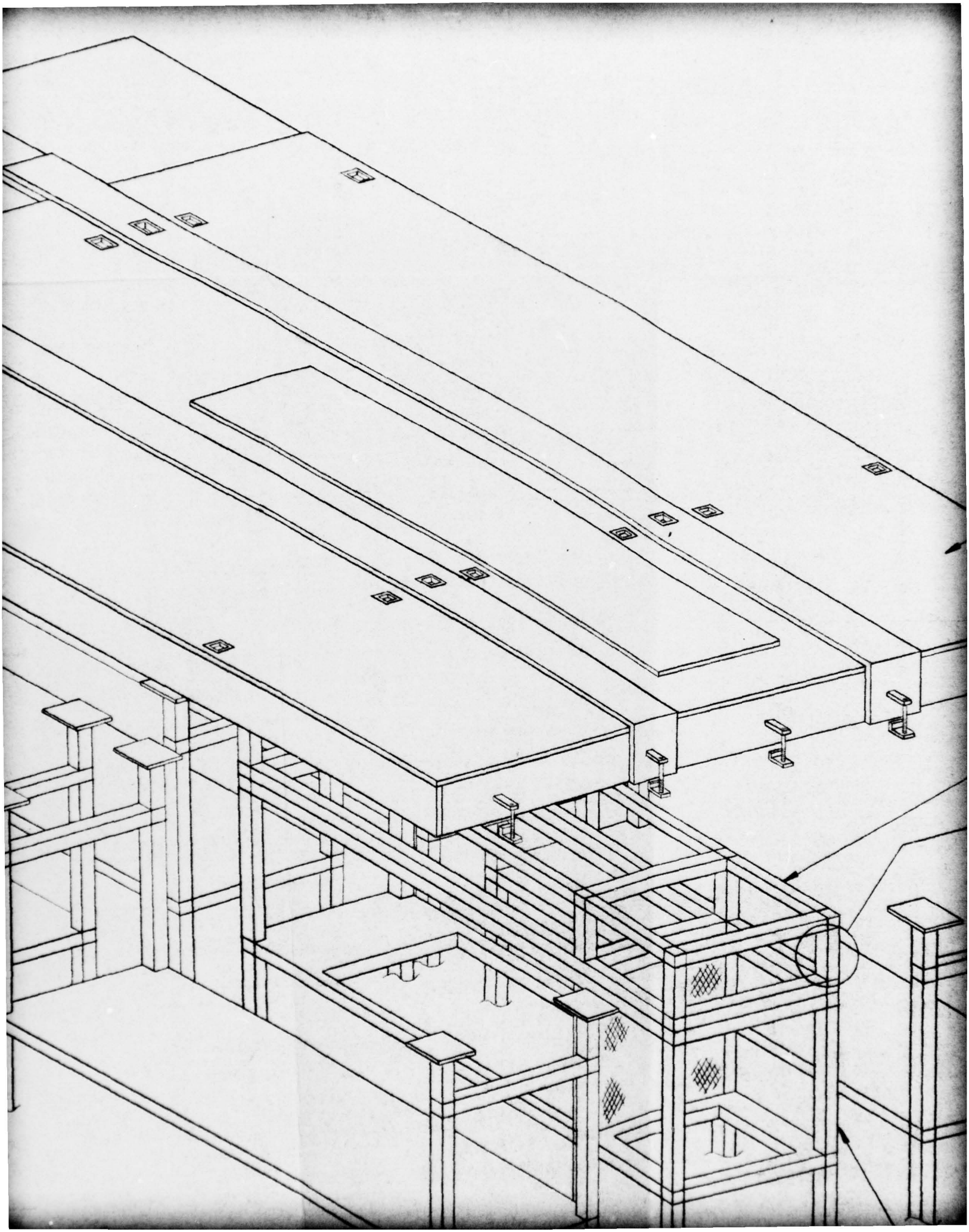
4-8. Subsystem Emplacement

The cover and T-assemblies would set to the proper length and then locked to that length using the integral quick acting clamps. Then, the cover and T-assemblies would be lifted onto the hatch coaming and attached to it using the adjustable clamps. Next, the cover seals would be installed and all gaps closed with industrial tape. Finally, the adapter assemblies would be installed between the hatch cover and the flat racks.

TABLE 4-1. CONCEPT B - LIGHT WEIGHT HATCH COVER SUBSYSTEM

Index No.	Assembly Name
1	Load Distribution Plate
2	Jack Screw
3	Support Post
4	Hatch Cover Adapter
5	Flat Rack
6	Lift Shaft
7	Hatch Cover House Adapter
8	Light Weight Hatch Cover





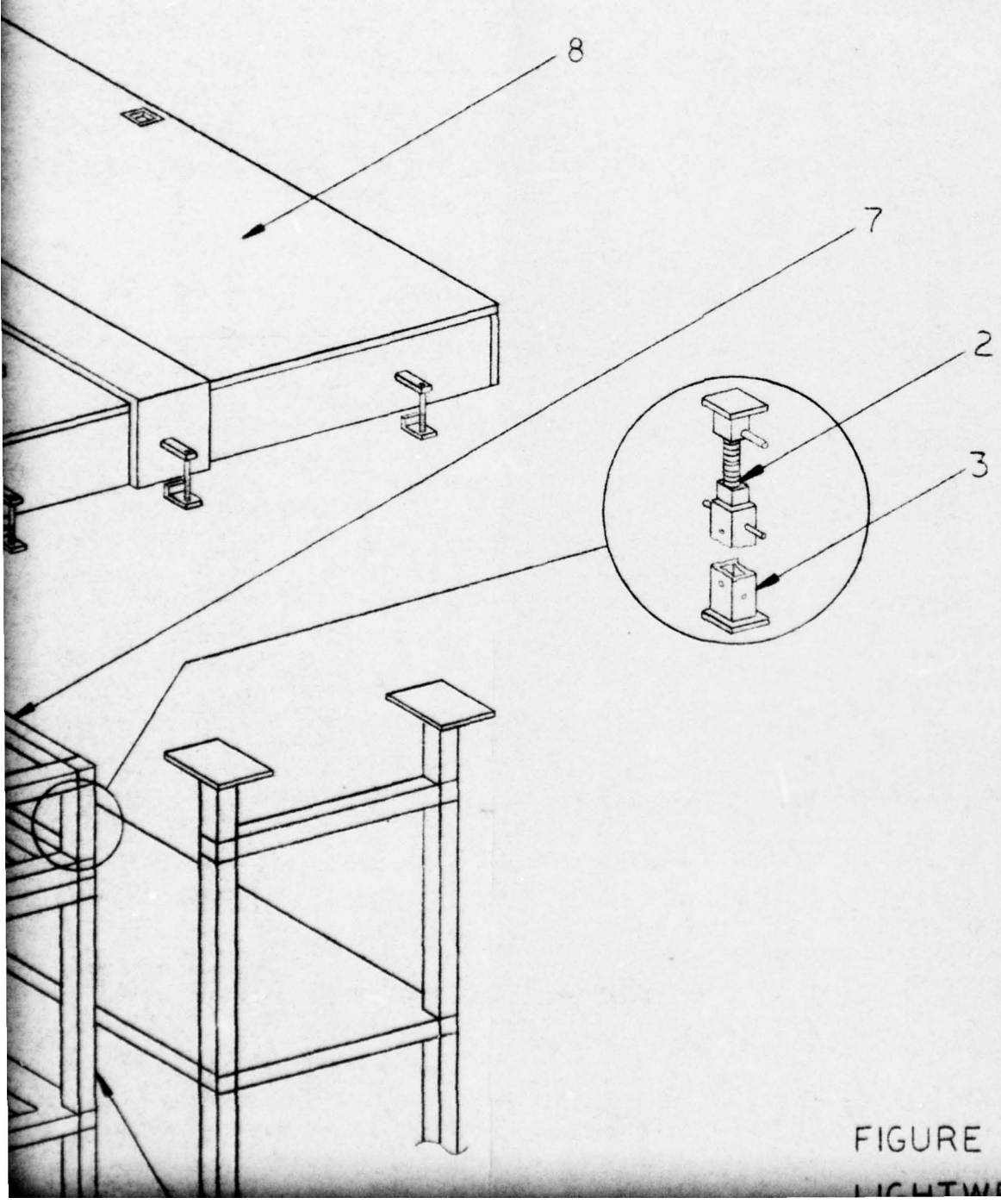


FIGURE 4-1. CONCEPT B-
LIGHTWEIGHT HATCH

5-1. CONCEPT C - ADAPTER AND SEAL HATCH COVER SUBSYSTEM

This subsystem, Table 5-1 and Figure 5-1 would consist of hatch cover adapter assemblies and hatch cover sealing assemblies. The sealing sections would consist of:

(a) port cover sealing assembly,

(b) inboard cover sealing assembly,

(c) starboard cover sealing assembly,

(d) fore and aft cover sealing assembly,

(e) port-to-starboard cover sealing assembly, and

(f) forward, aft, port and starboard cover seals.

All sealing assemblies would be of the telescoping type.

Table 5-2 lists the various combinations of the assemblies and seals (used with the hatch cover adapter assemblies) which would be required to make up various width hatch covers.

5-2. Hatch Cover Adapter Assembly

The assembly would be constructed similar to a standard flat rack, except that the columns (legs) would be extendable and retractable. The assembly, when not inverted, would function as a variable height flat rack. Each assembly, when inverted, would function as a portion of the hatch cover for this subsystem.

The assembly would be enclosed in a 20'0" deep by 8'0" wide by 2'0" high (retracted) or 8'6" high (extended) area and weigh about 4000 pounds. The

assembly would be installed in container guides, between the top most flat rack or container and the hatch cover sealing assemblies.

The assembly would be adjustable in height. The height would be regulated by support posts and jack screws. The support posts would control the coarse height adjustment and would consist of inner posts or box channels that would telescope into an outer post or box, respectively. The jack screws would provide fine height adjustment of the assembly.

5-3. Port Cover Sealing Assembly

The assembly would close the open (forward, port and aft) areas between the port hatch cover adapter assemblies and the hatch cover coaming. The longer than wide assembly would be approximately 9'0" wide (at both ends) by 2'0" high by 42'0" (retracted) or 44'0" (extended) deep and weigh about 3214 pounds.

The wider than long assembly would be approximately 10'0" wide (at both ends) by 2'0" high by 21'0" (retracted) and 35'0" (extended) and weigh about 4320 pounds.

The port cover sealing assembly would consist of two subassemblies, a long port and a short port subassembly. The long subassembly would consist of a port top and skirt plate attached to a right angle channel. Also this subassembly would have a forward top and skirt plate attached to the channel. Each skirt plate would have a cover seal. The longer than wide, long subassembly would be approximately 9'0" wide (forward) by 2'0" high by 40'0" deep and weigh about 2496 pounds. The wider than long, long subassembly would be approximately 10'0" wide (forward) by 2'0" high by 21'0" deep and weigh about 2360 pounds.

The short subassembly would consist of a port top and skirt plate attached

to a channel. Also this subassembly would have an aft top plate and skirt plate attached to the channel. In addition, each skirt plate would have a cover seal. The channel of the short subassembly would telescope into the channel of the long subassembly. The longer than wide, short subassembly would be approximately 9'0" wide (at the aft end) by 2'0" high by 6'0" deep and weigh about 718 pounds. The wider than long, short subassembly would be approximately 10'0" wide (at aft end) by 2'0" high by 16'0" deep and weigh about 1960 pounds.

The long and short subassemblies would be locked together by quick acting clamps after setting the assembly to the desired length. The top plate and skirt plate of the long subassembly would overlap the top plate and skirt plate of the subassembly when the short subassembly would either be fully extended out of or retracted into the long subassembly. The overlap between the top plate and skirt plate of the long and short subassemblies would be closed by industrial tape. The gaps between the overlapping skirt plates, at the cover seals, would be closed by standard lengths of cover seals. The standard length of cover seal would be attached to the inner face of the skirt plate of the long subassembly. The long assembly would have at least four lift fittings attached to it. The assembly would be secured to the coaming by adjustable clamps.

5-4. Inboard Cover Sealing Assembly

The assembly would close the open (forward, inboard and aft) areas between inboard hatch cover adapter assemblies and the hatch cover coaming.

The longer than wide assembly would be approximately 2'0" wide by 2'0" high by 44'0" deep and weigh about 1898 pounds.

The wider than long assembly would be approximately 3'0" wide by 2'0" high

by 35'0" deep and weigh about 2220 pounds.

The assembly would comprise of two subassemblies; a long inboard subassembly and a short inboard subassembly. The long subassembly would consist of a top plate attached to a box channel. This subassembly would have a forward skirt plate. The longer than wide, long subassembly would be approximately 2'0" wide by 2'0" high by 40'0" deep and weigh about 1612 pounds. The wider than long, long subassembly would be approximately 2'0" wide by 2'0" high by 21'0" deep and weigh about 1260 pounds.

The short subassembly would consist of a top plate attached to a box channel. This subassembly would have an aft skirt plate. The longer than wide, short subassembly would be approximately 2'0" wide by 2'0" high by 6'0" deep and weigh about 316 pounds. The wider than long, short subassembly would be approximately 2'0" wide by 2'0" high by 16'0" deep and weigh about 960 pounds.

The box of the short subassembly would telescope into the box of the long subsection. The top plate of the long subassembly would overlap the top plate of the short subassembly, when the short subassembly would be fully extended out of or retracted into the long subassembly. The top plate overlap would be sealed by industrial tape. The gaps between the forward and aft skirt plates of sealing subassemblies and the port or starboard cover sealing assembly, and the forward and aft cover sealing assembly, at the cover seal, would be closed by standard lengths of forward and aft cover seals and industrial tape. The standard length of cover seals would be attached to the inner face of the forward and aft skirt plates. The joints between the forward and aft skirt plate of the sealing assemblies and the cover sealing assemblies would be closed by industrial tape.

The assembly would have at least two lift fittings attached to it. The

assembly would be secured to the coaming by adjustable clamps.

5-5. Starboard Cover Sealing Assembly

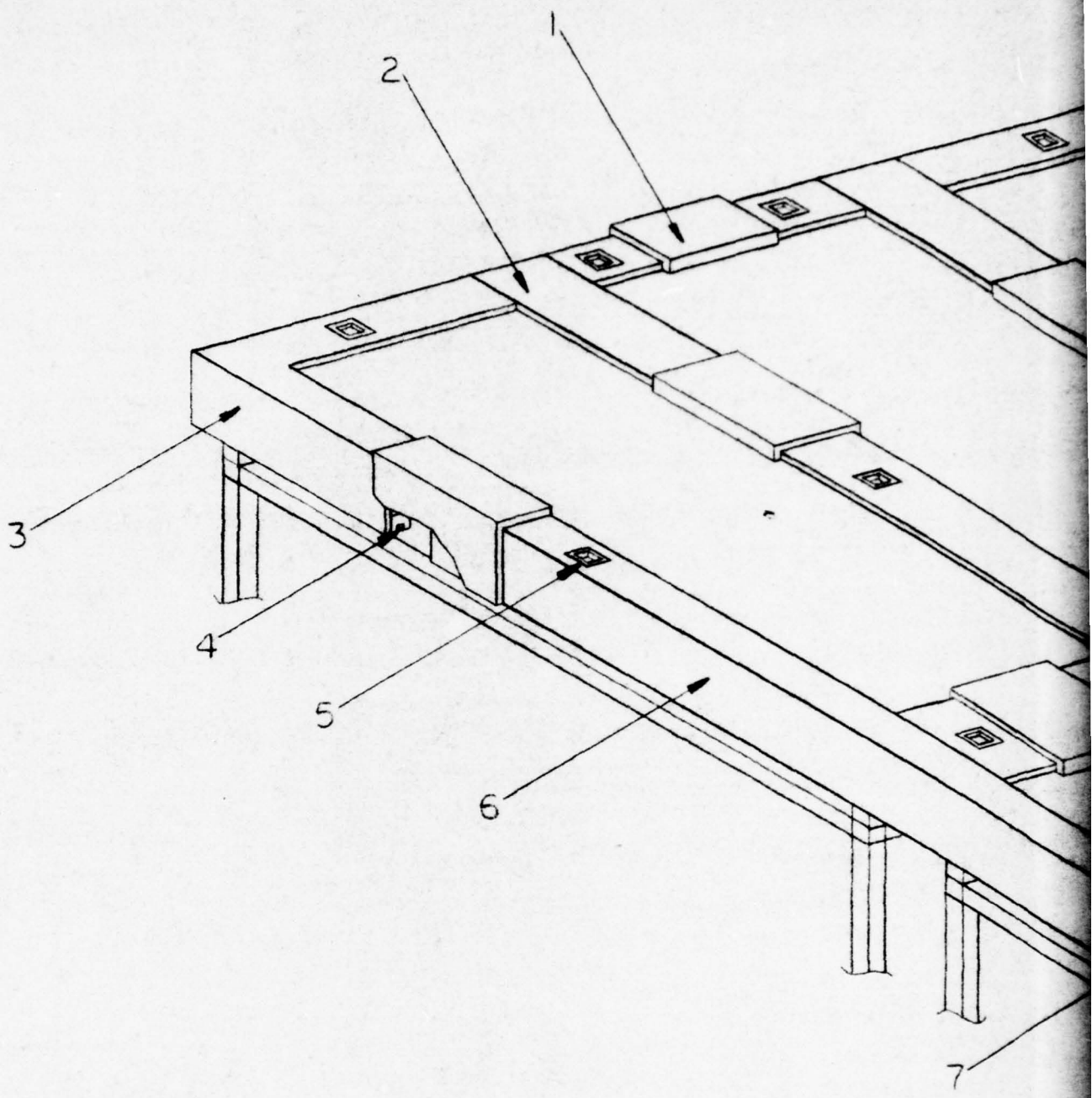
The starboard cover sealing assembly would be similar to the port cover sealing assembly, except that it would be of the opposite hand. The assembly would close the open (forward, starboard and aft) areas between the starboard hatch cover adapter assemblies and the hatch cover coaming.

5-6. Subsystem Emplacement

The inverted hatch cover adapter assemblies would be emplaced on the top-most upright hatch cover adapter assemblies, flat racks or containers. The inverted adapter assemblies would be raised to the height required to accept the cover sealing assemblies. Then, the cover sealing assemblies would be set to the proper length and then locked to that length using the integral quick acting clamps. Next, the cover sealing assemblies would be lifted into their respective positions between the adapter assemblies and the hatch cover coaming. The assemblies would be fastened by means of the adjustable clamps. Finally, the cover seals would be installed and all gaps closed with industrial tape.

TABLE 5-1. CONCEPT C - ADAPTER AND SEAL HATCH COVER SUBSYSTEM

Index No.	Assembly Name
1	Forward and Aft Cover Sealing Assembly
2	Short Inboard Cover Sealing Subassembly
3	Short Starboard Cover Sealing Subassembly
4	Section Seal
5	Aft Lift Fitting
6	Long Starboard Cover Sealing Subassembly
7	Forward Lift Fitting
8	Long Inboard Cover Sealing Subassembly
9	Adjustable Clamps
10	Hatch Cover House Adapter
11	Flat Rack
12	Support Post
13	Jack Screw
14	Hatch Cover Adapter
15	Port-to-Starboard Cover Sealing Assembly
16	Long Port Cover Sealing Subassembly
17	Short Port Cover Sealing Subassembly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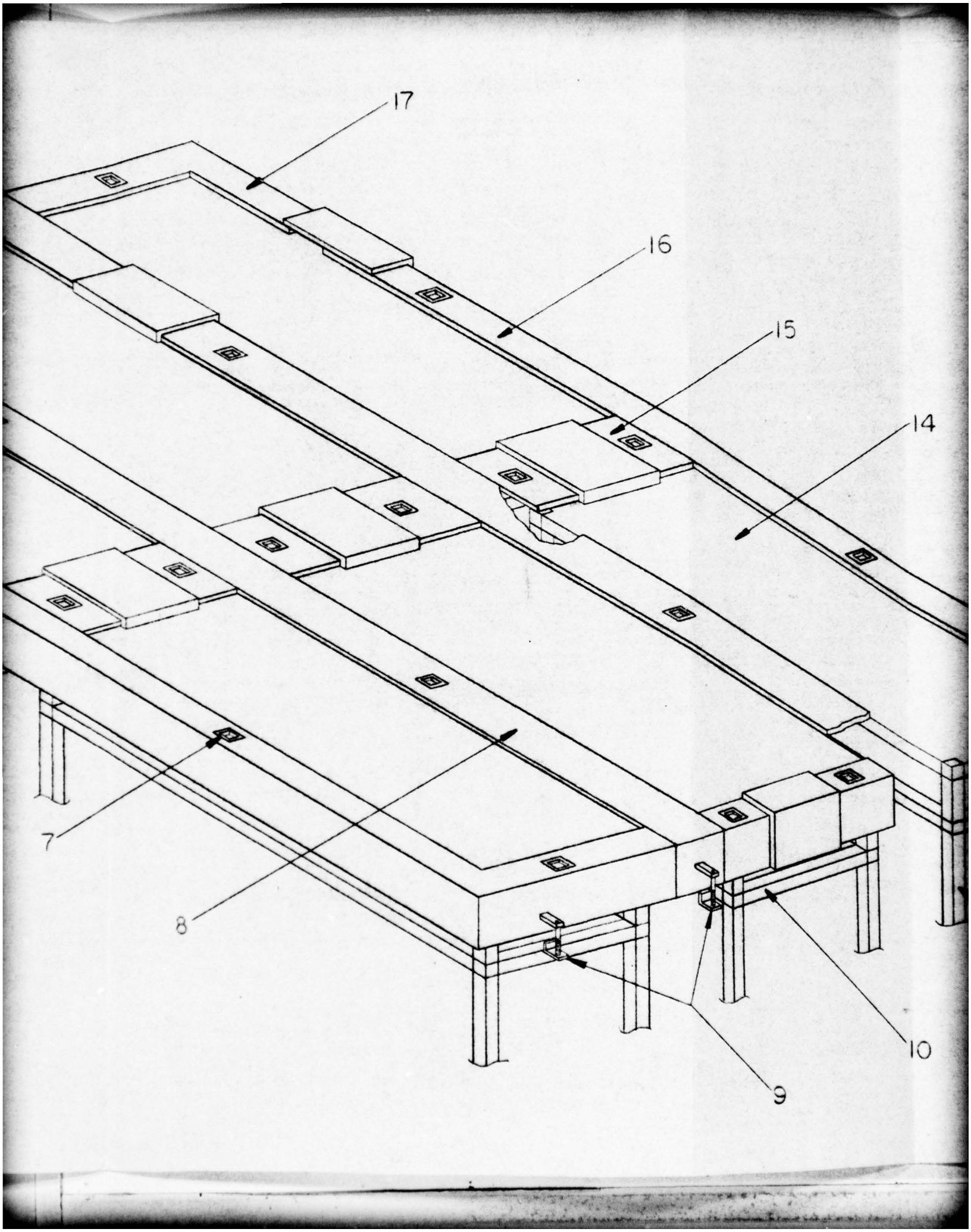
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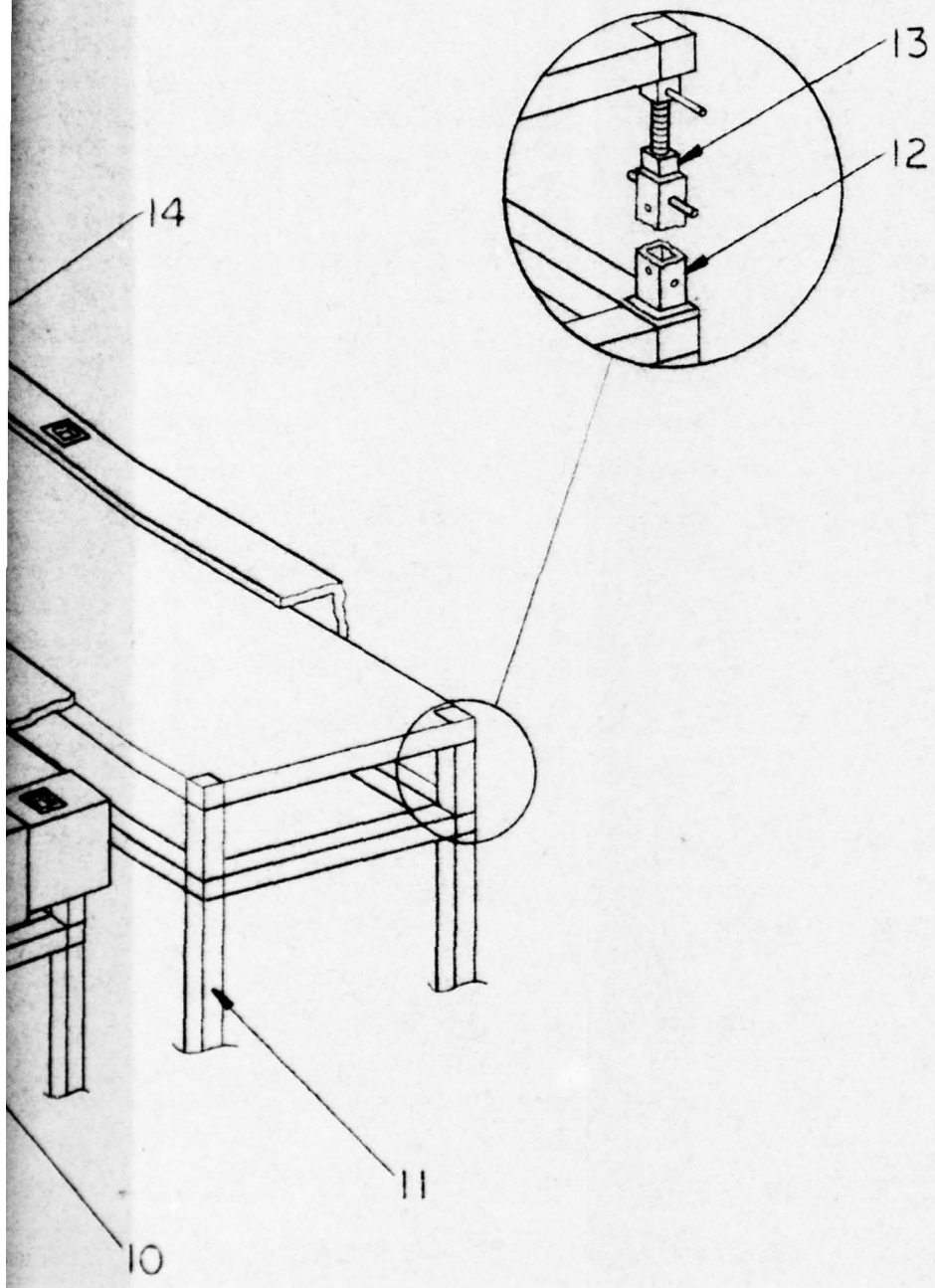


FIGURE 5-1. CONCEPT C-
ADAPTER AND SEAL HATCH
COVER SUBSYSTEM

TABLE 5-2. ASSEMBLY AND SEALS REQUIRED FOR VARIOUS WIDTH HATCH COVERS

(ADAPTER ASSEMBLIES)

Assembly and Seal	Hatch Cover		
	1 Container Deep by 8 Container Wide	2 Container Deep by 3 Container Wide	2 Container Deep by 4 Container Wide
Port Cover Sealing Assembly	1	1	1
Inboard Cover Sealing Assembly	7	2	3
Starboard Cover Sealing Assembly	1	1	1
Forward and Aft Cover Sealing Section	12	2	4
Port-to-Starboard Cover Sealing Assembly		3	4
Port Cover Seals	1	1	1
Starboard Cover Seals	1	1	1
Forward Cover Seals	7	2	3
Aft Cover Seals	7	2	3

6-1. CONCEPT D - MODIFIED PONTOON HATCH COVER SUBSYSTEM

This subsystem, Table 6-1 and Figure 6-1 would consist of:

(a) a modified hatch cover, and

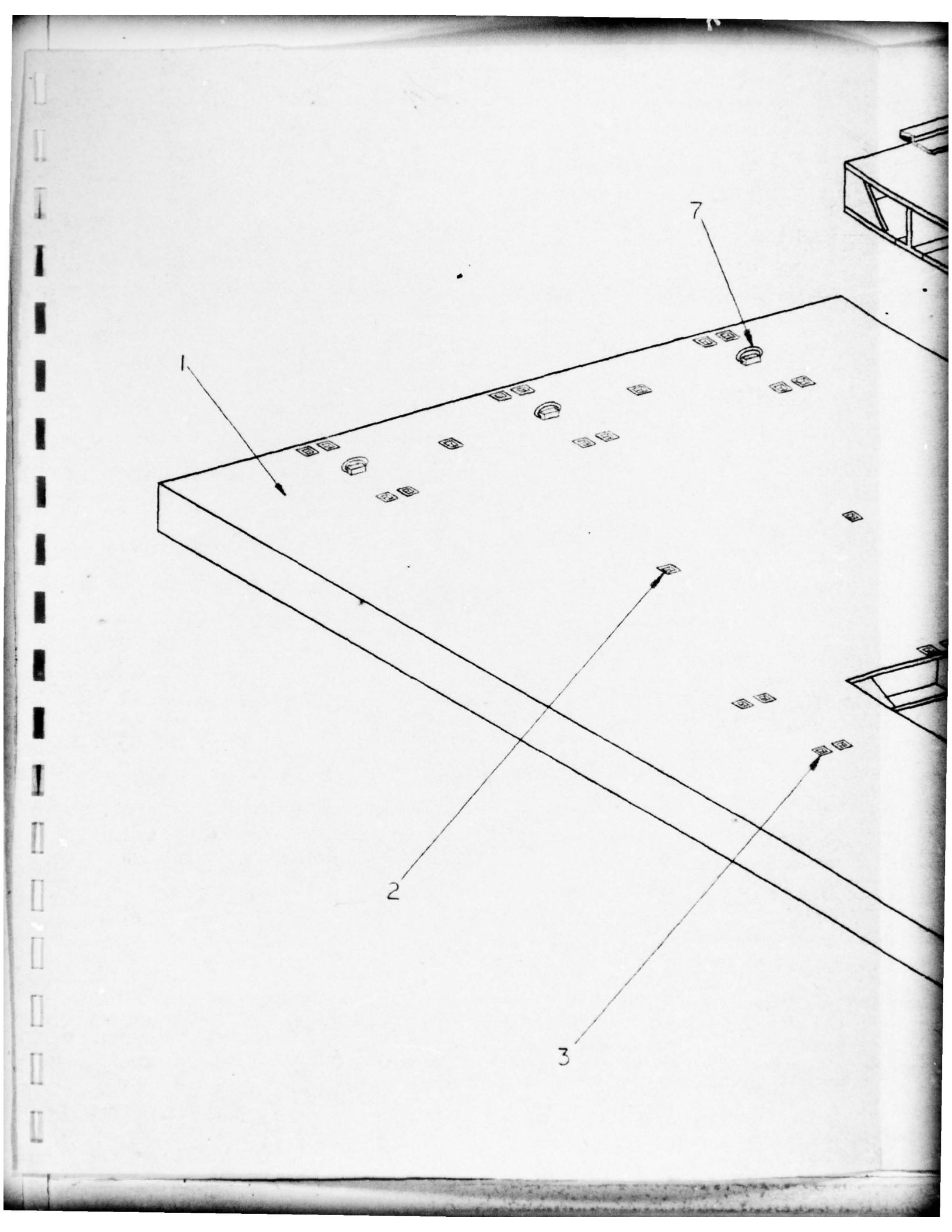
(b) an access cover plate and gasket assembly.

The subsystem would require the retrofit of existing hatch covers and also allow implementation into new construction. The hatch cover would be removed from the ship and shipped to a shop. In the shop, the cover would be fitted with an access. The access would be aligned with and accept the adapter assembly of the below hatch vertical material handling subsystem. The access would be fitted with a cover plate assembly. The cover plate would consist of a top plate, webbing, bottom plate and gasket. The cover plate assembly would be held in position by removable webbing spanner plates. Hand access holes would be provided in the bottom plate. The hand holes would allow the installation and removal of hardware used to fasten the webbing spanner plates between the webs of the hatch cover and the cover plate. When the cover plate was installed, the hatch would be used to stow above hatch containers in the normal manner. When the cover plate was removed it would allow the adapter assembly to penetrate the hatch cover and permit the below hatch vertical material handling subsystem to operate the normal manner. After retrofit, the modified hatch cover would be replaced on the ship.

While the hatch cover was being modified, the existing hold would be covered with a hatch cover consisting of planking and canvas.

TABLE 6-1. CONCEPT D - MODIFIED PONTOON HATCH COVER SUBSYSTEM

Index No.	Assembly Name
1	Modified Hatch Cover
2	Lift Fitting
3	Container Fitting
4	Access
5	Webbing Spanner Plate
6	Cover Plate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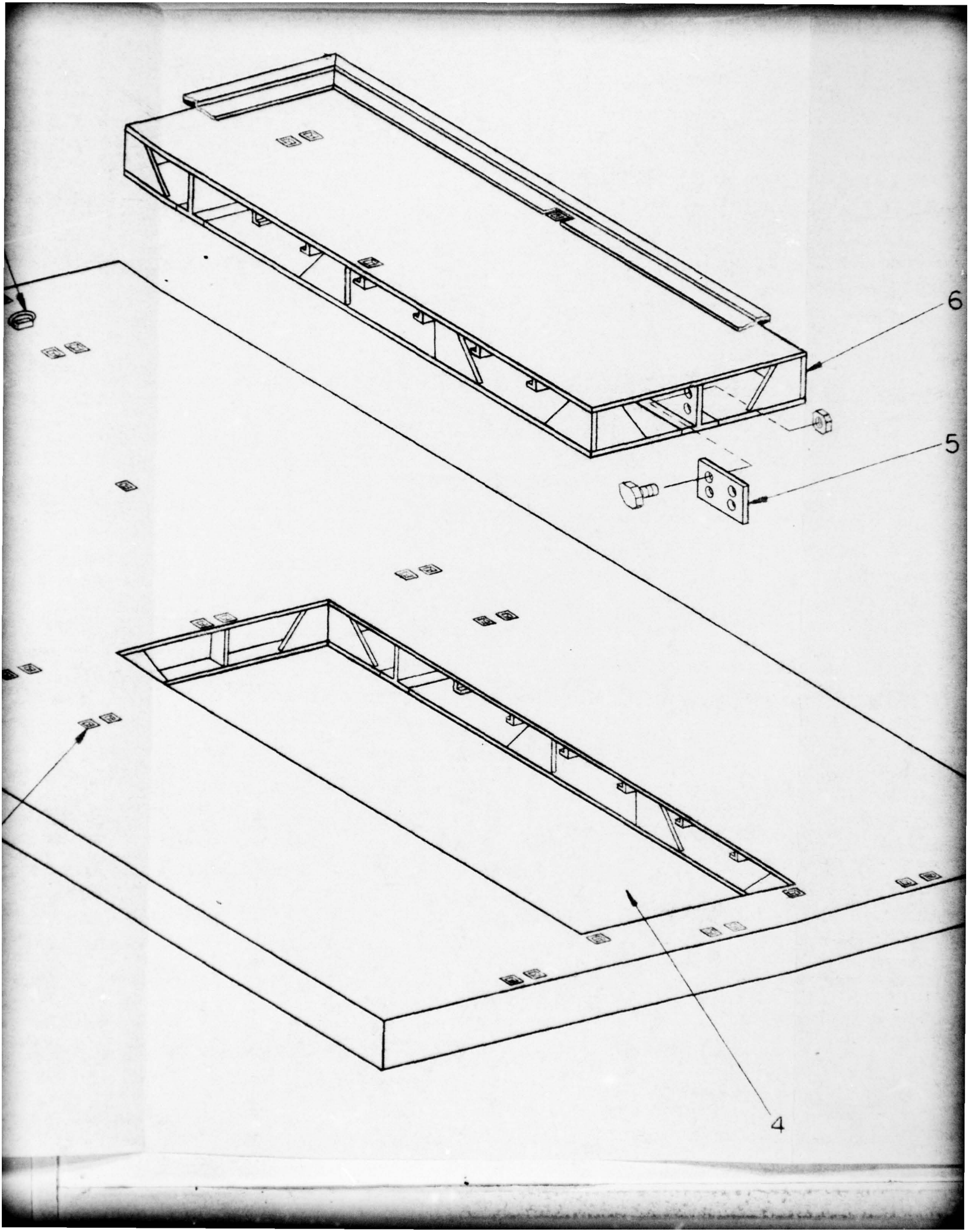
2
3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5
4

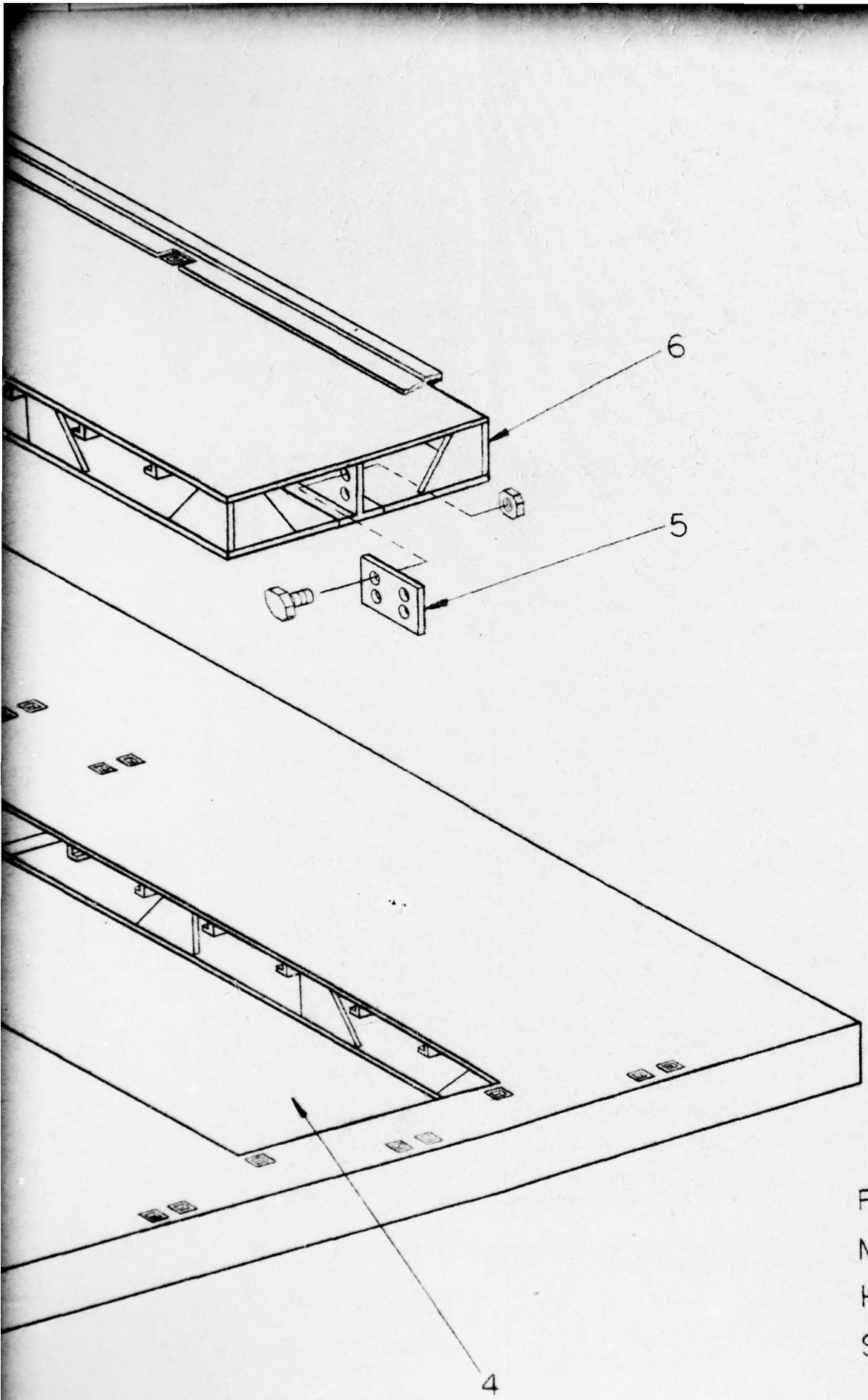

FIGURE 6-1. CONCEPT
MODIFIED PONTOON
HATCH COVER
SUBSYSTEM

7-1. UNIVERSAL PONTOON HATCH COVER SUBSYSTEM DETAILED CHARACTERISTICS

Table 7-1 presents the detailed characteristics of subsystems and assemblies. The table is divided into nine elements;

(a) physical,

(b) engineering,

(c) detailing,

(d) purchasing,

(e) stowing,

(f) emplacement,

(g) maintenance, and

(h) failure.

The elements are selected because they would give a starting point of comparison between each assembly and in turn, between each subsystem.

Under each concept, the first line is the total subsystem entry, while the lines below the subsystem are the assembly entries.

Opposite each ASSEMBLY, in the ELEMENT column is the criteria entry (e.g., 44'0", 8'0", 2'0", etc.). The criteria entry is based upon an engineering estimate obtained by examination of all preceding text, figures and tables.

Opposite each SUBSYSTEM, in the ELEMENT column is the totaled criteria entry (e.g., 44'0", 35'0", 2'0", etc.). The totaled criteria entry provides a detailed overview of the subsystem characteristics.

The following notes pertain to Table 7-1:

Note	Meaning
(a)	Weight for one of each assembly.
(b)	Weight of each assembly.
(c)	Quantity required for three container wide and two container deep hatch cover.
(d)	Like letters indicate similarity in design.

The table functions as a source document from which the advantages and disadvantages of each subsystem may be obtained. Subsequent paragraphs list the advantages and disadvantages of each subsystem. The list of the advantages and disadvantages of each subsystem is an internal comparison within each subsystem, not a comparison between each subsystem.

TABLE 7-1. UNIVERSAL PONTOON HATCH CO

SUBSYSTEM AND ASSEMBLY	PHYSICAL CONFIGURATION					ENGINEERING DESIGN				DETAILING DESIGN		
	DEPTH	WIDTH	HEIGHT	WEIGHT	QUANTITY REQUIRED	SIMILAR	SIMPLE	INTERMEDIATE	COMPLEX	SIMPLE	INTERMEDIATE	COMPLEX
CONCEPT A				(a)	(c)	(d)						
Standard Weight Hatch Cover (Longer Than Wide)	44'0"	35'0"	2'0"	30136# (b)	1	A	X	X	X	X	X	X
Port Cover	44'0"	8'0"	2'0"	9568#	1	B	-	-	X	-	-	X
Inboard Cover	44'0"	8'0"	2'0"	8372#	1	B	-	-	X	-	-	X
Starboard Cover	44'0"	8'0"	2'0"	9568#	1	B	-	-	X	-	-	X
T-Section	44'0"	2'0"	2'0"	2496#	2	C	-	X	-	-	X	-
Forward Cover Seal	1'6"	3"	3"	28#	2	D	X	-	-	X	-	-
Aft Cover Seal	1'6"	3"	3"	28#	2	D	X	-	-	X	-	-
Port Cover Seal	2'0"	3"	3"	38#	1	E	X	-	-	X	-	-
Starboard Cover Seal	2'0"	3"	3"	38#	1	E	X	-	-	X	-	-

SUBSYSTEM AND ASSEMBLY	PHYSICAL CONFIGURATION					ENGINEERING DESIGN				DETAILING DESIGN		
	DEPTH	WIDTH	HEIGHT	WEIGHT	QUANTITY REQUIRED	SIMILAR	SIMPLE	INTERMEDIATE	COMPLEX	SIMPLE	INTERMEDIATE	COMPLEX
CONCEPT B				(a)	(c)	(d)						
Light Weight Hatch Cover (Longer Than Wide)	44'0"	35'0"	2'0"	17952# (b)	1	A	X	X	X	X	X	X
Port Cover	44'0"	8'0"	2'0"	5600#	1	B	-	-	X	-	-	X
Inboard Cover	44'0"	8'0"	2'0"	4720#	1	B	-	-	X	-	-	X
Starboard Cover	44'0"	8'0"	2'0"	5600#	1	B	-	-	X	-	-	X
T-Section	44'0"	2'0"	2'0"	880#	2	C	-	X	-	-	X	-
Forward Cover Seal	1'6"	3"	3"	28#	2	D	X	-	-	X	-	-
Aft Cover Seal	1'6"	3"	3"	28#	2	D	X	-	-	X	-	-
Port Cover Seal	2'0"	3"	3"	38#	1	E	X	-	-	X	-	-
Starboard Cover Seal	2'0"	3"	3"	38#	1	E	X	-	-	X	-	-
Hatch Cover Adapter	8"	8"	8'6"	30#	24	F	X	-	-	X	-	-

PONTOON HATCH COVER SUBSYSTEMS CHARACTERSITICS MATRIX

ELEMENTS																
DETAILING DESIGN			PURCHASING METHOD		STOWING SHELF LIFE			EMPLACEMENT METHOD			PREVENTIVE MAINTENANCE PROCEDURE			FAILURE RATE		
E	INTERMEDIATE	COMPLEX	NEW BUILD	OFF-SHELF	SHORT	MODERATE	LONG	SIMPLE	INTERMEDIATE	COMPLEX	SIMPLE	INTERMEDIATE	COMPLEX	LOW	MODERATE	HIGH
	X	X	8 Assemblies out of 8	None	-	X	X	X	X	-	X	X	-	X	X	-
	-	X	X	-	-	X	-	-	X	-	-	X	-	-	X	-
	-	X	X	-	-	X	-	-	X	-	-	X	-	-	X	-
	-	X	X	-	-	X	-	-	X	-	-	X	-	-	X	-
	X	-	X	-	-	X	-	-	X	-	-	X	-	-	X	-
	-	-	X	-	-	-	X	X	-	-	X	-	-	X	-	-
	-	-	X	-	-	-	X	X	-	-	X	-	-	X	-	-
	-	-	X	-	-	-	X	X	-	-	X	-	-	X	-	-
	-	-	X	-	-	-	X	X	-	-	X	-	-	X	-	-

ELEMENTS																
DETAILING DESIGN			PURCHASING METHOD		STOWING SHELF LIFE			EMPLACEMENT METHOD			PREVENTIVE MAINTENANCE PROCEDURE			FAILURE RATE		
E	INTERMEDIATE	COMPLEX	NEW BUILD	OFF-SHELF	SHORT	MODERATE	LONG	SIMPLE	INTERMEDIATE	COMPLEX	SIMPLE	INTERMEDIATE	COMPLEX	LOW	MODERATE	HIGH
	X	X	9 Assemblies out of 9	None	-	X	X	X	X	-	X	X	-	X	X	-
	-	X	X	-	-	X	-	-	X	-	-	X	-	-	X	-
	-	X	X	-	-	X	-	-	X	-	-	X	-	-	X	-
	-	X	X	-	-	X	-	-	X	-	-	X	-	-	X	-
	X	-	X	-	-	X	-	-	X	-	-	X	-	-	X	-
	-	-	X	-	-	-	X	X	-	-	X	-	-	X	-	-
	-	-	X	-	-	-	X	X	-	-	X	-	-	X	-	-
	-	-	X	-	-	-	X	X	-	-	X	-	-	X	-	-
	-	-	X	-	-	-	X	X	-	-	X	-	-	X	-	-
	-	-	X	-	-	-	X	-	X	-	X	-	-	X	-	-

TABLE 7-1. UNIVERSAL PONTOON HATCH COVER SUBSYSTEMS

SUBSYSTEM AND ASSEMBLY	ELEMENTS												
	PHYSICAL CONFIGURATION					ENGINEERING DESIGN				DETAILING DESIGN			PURCHAS METH
	DEPTH	WIDTH	HEIGHT	WEIGHT	QUANTITY REQUIRED	SIMILAR	SIMPLE	INTERMEDIATE	COMPLEX	SIMPLE	INTERMEDIATE	COMPLEX	NEW BUILD
CONCEPT C				(a)	(c)	(d)							
Adapter and Seal Hatch Cover Subsystem (Longer Than Wide)	44'0"	35'0"	2'0"	13238# (b)	1	G	X	X	-	X	X	-	10 Assemblies out of 10
Port Cover Sealing Section	44'0"	9'0"	2'0"	3214#	1	H	-	X	-	-	X	-	X
Inboard Cover Sealing Section	44'0"	2'0"	2'0"	1898#	2	H	-	X	-	-	X	-	X
Starboard Cover Sealing Section	44'0"	9'0"	2'0"	3214#	1	H	-	X	-	-	X	-	X
Forward-and-Aft Cover Sealing Section	6'0"	2'0"	2'0"	312#	2	I	-	X	-	-	X	-	X
Port-to-Starboard Cover Sealing Section	6'0"	3'0"	2'0"	468#	3	I	-	X	-	-	X	-	X
Forward Cover Seal	1'6"	3"	3"	28#	2	D	X	-	-	X	-	-	X
Aft Cover Seal	1'6"	3"	3"	28#	2	D	X	-	-	X	-	-	X
Port Cover Seal	2'0"	3"	3"	38#	1	E	X	-	-	X	-	-	X
Starboard Cover Seal	2'0"	3"	3"	38#	1	E	X	-	-	X	-	-	X
Hatch Cover Adapter	2'0"	8'0"	8'6"	4000#	6	J	X	-	-	X	-	-	X

SUBSYSTEM AND ASSEMBLY	ELEMENTS												
	PHYSICAL CONFIGURATION					ENGINEERING DESIGN				DETAILING DESIGN			PURCHAS METH
	DEPTH	WIDTH	HEIGHT	WEIGHT	QUANTITY REQUIRED	SIMILAR	SIMPLE	INTERMEDIATE	COMPLEX	SIMPLE	INTERMEDIATE	COMPLEX	NEW BUILD
CONCEPT D				(a)	(c)	(d)							
Modified Hatch Cover (Longer Than Wide)	43'1"	26'9"	2'0"	47000# (b)	1	K	X	-	-	X	-	-	2 Assemblies out of 2
Modified Hatch Cover	43'1"	26'9"	2'0"	40000#	1	L	X	-	-	X	-	-	X
Cover Plate	20'0"	8'0"	2'0"	7000#	1	M	X	-	-	X	-	-	X

HATCH COVER SUBSYSTEMS CHARACTERISTICS MATRIX (Continued)

ELEMENTS															
ETAILING DESIGN		PURCHASING METHOD		STOWING SHELF LIFE			EMPLACEMENT METHOD			PREVENTIVE MAINTENANCE PROCEDURE			FAILURE RATE		
RMEDIATE	COMPLEX	NEW BUILD	OFF-SHELF	SHORT	MODERATE	LONG	SIMPLE	INTERMEDIATE	COMPLEX	SIMPLE	INTERMEDIATE	COMPLEX	LOW	MODERATE	HIGH
X	-	10 Assemblies out of 10	None	-	X	X	X	X	-	X	X	-	X	X	-
X	-	X	-	-	X	-	-	X	-	-	X	-	-	X	-
X	-	X	-	-	X	-	-	X	-	-	X	-	-	X	-
X	-	X	-	-	X	-	-	X	-	-	X	-	-	X	-
X	-	X	-	-	X	-	-	X	-	-	X	-	-	X	-
X	-	X	-	-	X	-	-	X	-	-	X	-	-	X	-
-	-	X	-	-	-	X	X	-	-	X	-	-	X	-	-
-	-	X	-	-	-	X	X	-	-	X	-	-	X	-	-
-	-	X	-	-	-	X	X	-	-	X	-	-	X	-	-
-	-	X	-	-	-	X	X	-	-	X	-	-	X	-	-
-	-	X	-	-	-	X	-	X	-	X	-	-	X	-	-

ELEMENTS															
DETAILING DESIGN		PURCHASING METHOD		STOWING SHELF LIFE			EMPLACEMENT METHOD			PREVENTIVE MAINTENANCE PROCEDURE			FAILURE RATE		
TERMEDIATE	COMPLEX	NEW BUILD	OFF-SHELF	SHORT	MODERATE	LONG	SIMPLE	INTERMEDIATE	COMPLEX	SIMPLE	INTERMEDIATE	COMPLEX	LOW	MODERATE	HIGH
-	-	2 Assemblies out of 2	None	-	-	X	X	-	-	X	-	-	X	-	-
-	-	X	-	-	-	X	X	-	-	X	-	-	X	-	-
-	-	X	-	-	-	X	X	-	-	X	-	-	X	-	-

7-2. Standard Weight Hatch Cover Subsystem

This subsystem would provide the following advantages;

(a) medium weight,

(b) simple-to-intermediate emplacement method,

(c) simple-to-moderate maintenance procedures, and

(d) low-to-moderate failure rate.

This subsystem would provide the following disadvantages;

(a) complex engineering and detailing design,

(b) no major assemblies purchased from off-shelf stock, and

(c) moderate stowage life.

7-3. Light Weight Hatch Cover Subsystem

The advantages of this subsystem would be;

(a) light weight,

(b) simple-to-intermediate emplacement method, and

(c) simple-to-moderate maintenance procedures.

The disadvantages of this subsystem would be;

(a) complex engineering and detailing design,

(b) no major assemblies purchased from off-shelf stock,

(c) moderate stowage life, and

(d) moderate failure rate.

7-4. Adapter and Seal Hatch Cover Subsystem

Subsystem advantages would be;

(a) simple-to-intermediate engineering and detailing design, and

(b) moderate-to-long stowage life.

Subsystem disadvantages would be;

(a) heavy weight,

(b) no major assemblies purchased from off-shelf stock,

(c) intermediate complex emplacement method and maintenance procedures, and

(d) moderate failure rate.

7-5. Modified Hatch Cover

The advantages of this subsystem would be;

(a) simple engineering and detailing design,

(b) long usage life,

(c) simple emplacement method,

(d) simple maintenance procedures, and

(e) low failure rate, and

(f) lightest weight.

The disadvantages of this subsystem would be;

(a) no major assemblies purchased from off-shelf stock.

7-6. UNIVERSAL PONTOON HATCH COVER SUBSYSTEMS COSTS

Table 7-2 provides an approximate overall cost of each subsystem. The cost of each subsystem was obtained by multiplying the weight of the assembly in pounds, by $1.50 per pound of assembly weight. In the table, the cost of Concept D - Modified Pontoon Hatch Cover, would be the cost for new construction and retrofit.

TABLE 7-2. UNIVERSAL PONTOON HATCH COVER SUBSYSTEMS COSTS

SUBSYSTEM	WEIGHT (LBS)* ASSEMBLIES	COST $1.50/LB
Standard Weight Hatch Cover	30136	45204
Light Weight Hatch Cover	17952	26928
Adapter and Seal Hatch Cover	37238	55857
Modified Pontoon Hatch Cover	7000	10500

* Weight is the maximum number of assemblies required for 2 long by 3 wide 20' container hatch cover.

7-7. UNIVERSAL PONTOON HATCH COVER SUBSYSTEMS WEIGHTED CHARACTERISTICS MATRIX

Table 7-3 presents a condensed version of the general characteristics of each subsystem. The characteristics are assigned a relative value which provides a quick look comparison of each subsystem.

Opposite the SUBSYSTEM, in the ELEMENT columns, between the horizontal lines is the criteria entry (e.g., 3080, 30136, Complex, etc.) The criteria entry was based upon a value decision obtained by analysis and evaluation of all preceding material.

Opposite the SUBSYSTEM, in the ELEMENT columns, to the left of the diagonal line is the weight criteria entry (e.g., 1, 2, 3, etc.) The weighted criteria entry was developed by assigning a number to the criteria entry. The number 1, indicates most desirable criteria. The numbers 2, and 3 indicate less desirable criteria. The number 4, indicates the least desirable criteria.

Opposite the SUBSYSTEM, in the ELEMENT columns, to the right of the diagonal line is accumulated weight entry (e.g., 1, 3, 6, etc.) The accumulated weight entry was obtained by adding together all previously weighted criteria entries.

TABLE 7-3. UNIVERSAL PONTOON HATCH COVER SUBSYSTEMS WEIGHTED CHARACTER

SUBSYSTEM	ELEMENT							
	OVERALL VOLUME (CU FT)	OVERALL WEIGHT (LBS)	ENGINEERING DESIGN	DETAILING DESIGN	PURCHASING OFF SHELF (%)	STOWING SHELF LIFE	EMPLACEMENT METHOD	
	3080	30136	Complex	Complex	0	Moderate	Intermediate	
Standard Weight Hatch Cover	1 / 1	2 / 3	3 / 6	3 / 9	3 / 12	3 / 15	2 / 17	
	3080	17952	Complex	Complex	0	Moderate	Intermediate	
Light Weight Hatch Cover	1 / 1	1 / 2	4 / 6	4 / 10	4 / 14	4 / 18	3 / 21	
	3080	37238	Intermediate	Intermediate	0	Moderate	Intermediate	
Adapter and Seal Hatch Cover	1 / 1	3 / 4	2 / 6	2 / 8	2 / 10	2 / 12	4 / 16	
	3080	47000	Simple	Simple	0	Long	Simple	
Modified Hatch Cover	1 / 1	4 / 5	1 / 6	1 / 7	1 / 8	1 / 9	1 / 10	

TABLE 7-3. UNIVERSAL PONTOON HATCH COVER SUBSYSTEMS WEIGHTED CHARACTERISTICS MATRIX

ELEMENT									
ALL (CU FT)	OVERALL WEIGHT (LBS)	ENGINEERING DESIGN	DETAILING DESIGN	PURCHASING OFF SHELF (%)	STOWING SHELF LIFE	EMPLACEMENT METHOD	PREVENTIVE MAINTENANCE PROCEDURES	FAILURE RATE	COST
0	30136	Complex	Complex	0	Moderate	Intermediate	Intermediate	Moderate	45204
1	2 3	3 6	3 9	3 12	3 15	2 17	2 19	2 21	3 24
0	17952	Complex	Complex	0	Moderate	Intermediate	Intermediate	Moderate	26928
1	1 2	4 6	4 10	4 14	4 18	3 21	3 24	3 27	2 29
0	37238	Intermediate	Intermediate	0	Moderate	Intermediate	Intermediate	Moderate	55857
1	3 4	2 6	2 8	2 10	2 12	4 16	4 20	4 24	4 28
0	47000	Simple	Simple	0	Long	Simple	Simple	Low	10500
1	4 5	1 6	1 7	1 8	1 9	1 10	1 11	1 12	1 13

7-8. RECOMMENDATIONS

It is recommended that the Modified Hatch Cover Subsystem be adopted as the most desirable universal pontoon hatch cover subsystem because of the following reasons;

(a) cover would support above hatch containers,

(b) simple engineering and detailing design,

(c) long usage life,

(d) standard emplacement methods,

(e) minimal maintenance requirements,

(f) low failure rate, and

(g) applicable to retrofit and new construction.

The load derating of retrofitting existing hatch cover is acceptable because of the advantage gained by using existing hatch cover. The load derating of new construction, because of the access penetration and cover plate, can be overridden by proper structural design.

It is recommended that the other subsystems be rejected as the most desirable device because of one or more of the following reasons;

(a) cover would not support above hatch containers,

(b) unproven design,

(c) moderate-to-complex engineering and detailing design,

(d) moderately short usage life,

(e) moderately complex emplacement method,

(f) simple-to-moderate maintenance requirements,

(g) moderately high failure rate.